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CENTER LINE

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CENTER LINE

Volume IX Number 1

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Center Line is published every other month in the interest of the management, employees and others dedicated to the Montana highway program. It is designed to present information on highway construction, progress, people and places.

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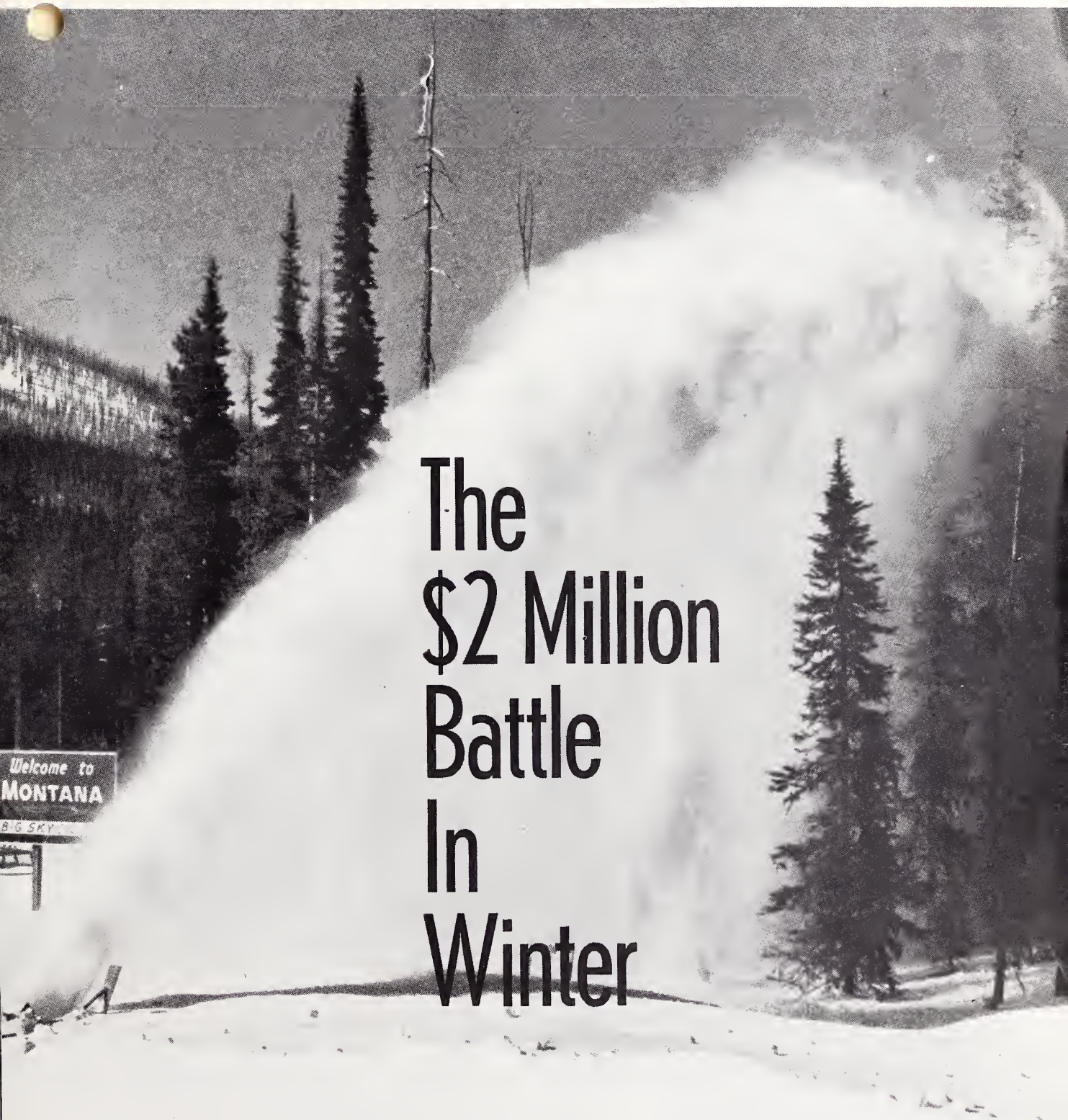
FRONT COVER

A routine concrete pouring job is dramatically captured on film for this issue's cover picture. The scene was taken in early February at Craig, where COP Construction Company was pouring bents (concrete columns) for the new I-15 bridge across the Missouri River. The camera stopped action just as the worker was guiding the concrete bucket, which is attached to a crane, over the forms of the bent. Visible at the bottom of the photo is the form structure and the funnel-type guide through which the concrete is dumped into the bottom of the form.



The $2 Million Battle In Winter

Bulky grey clouds build up in the sky. The temperature drops. Warnings go out and Montanans button up. Snow is on its way.

The time could be as early as September or as late as May. Snow is not confined to certain months in the Big Sky Country. Nor is it confined to specific days. Elevations ranging from 12,000 feet to 1,600 feet above sea level add still another dimension to the varied and often misunderstood winter scene in Montana.

(*continued*)

Winters in Montana are sometimes mild. Snow will haunt only the higher mountain passes and ski country for weeks on end. Temperatures in the cities and valleys bob up into the 40s and down into the 20s with the regularity of a yo-yo.

It is times such as this that Montana's Highway Department takes a breather during its annual $2 million battle to keep some 6,000 miles of highways open around the clock. But, as everyone in Montana knows, these breathers don't last.

Conditions Vary

When snow does come to Montana, it generally is ordered up by the ton with sub-zero weather to match.

The mountainous regions of western Montana receive the heaviest snowfall. Kings Hill along U. S. 89 south of Great Falls will stack up six to ten feet of snow during a single winter. Snow at Summit next door to Glacier National Park gets even deeper.

Eastern Montana, on the other hand, has flat terrain and inherits less snowfall during an average winter. Yet, the plains country presents an equally tough winter maintenance problem with blinding ground blizzards and hazardous drifting along highways.

Keeping Montana's roads open throughout the winter is a tough and often bitter cold task. It's a costly job, too. Snow removal and roadway maintenance in winter takes up about 25 percent of the annual maintenance budget. But increasing traffic and service demands by the traveling public make it a necessary job.

Organizational Key

And, with more than four decades of experience, Montana's highway maintenance forces have organized a system that provides the best possible winter highway service at the lowest possible cost.

The Highway Department maintains 5,947 miles of Interstate and Primary highway. An additional 306 miles of secondary roadway are scraped, blown, sanded and salted by state crews. Five administrative districts, each headed by a district engineer, are responsible for these more than 6,000 miles of roadway.

Montana highway men live with snow each year. It doesn't creep up on them without warning, for snow is a fact of life in the Big Sky Country. Consequently, extensive preparation for winter goes on all summer.

Mechanics repair engines and machines, preparing all snow removal equipment for the expected snows. Radio maintenance men climb towers of communication in the field to insure perfect connections. Highway shops in each district paint, tear down, grease, and re-assemble. Snow tires and chains are stockpiled. Private contractors and in many cases highway crews feed rocks into giant crushers, making sand.

And then it happens.

Clouds begin building up. The temperature drops. Warnings go out and Montanans button up. The inevitable enemy is on its way.

Weapons of War

Maintenance plans depend heavily on effective use of chemicals; either straight or mixed with abrasives. Last year, the department used 670 tons of salt and 47 tons of calcium chloride. Salt is applied at a rate of 200 to 400 pounds per mile and is not mixed. Calcium chloride is mixed with sand or other anti-skid materials at the ratio of 100 pounds to a cubic yard of abrasive material.

Montana uses about 75,000 tons of sand, cinders, coal slack and mine dump materials for anti-skid. This material is applied by specially designed sanding trucks with capacities ranging from three up to six cubic yards.

Sand is the most widely used anti-skid material. But costs are often cut in Montana by using natural materials as they are available. The Great Falls and Billings district, for example,

(*continued*)

MONTANA SNOWFALL RECORD

Ten Year Figures*
In Inches

City	High	Low	Average
Butte	95.6	26.5	56.8
Dillon	50.2	18.2	35.4
Great Falls	95.8	38.8	62.4
Kalispell	115.2	40.2	68.0
Missoula	73.6	31.5	47.4
Helena	78.6	24.7	53.8
Billings	127.9	30.0	63.2
Glasgow	32.4	19.5	25.7
Havre	70.8	27.2	45.1
Harlowton	65.4	29.1	41.1
Lewistown	69.6	24.7	48.1
Livingston	103.2	40.2	56.1
Miles City	37.6	16.5	27.7
Mountainous Regions			
West Yellowstone	216.2	136.1	187.2
West Glacier	249.7	134.5	166.4
Summit	-------	151.5	280.2
Kings Hill	330.0	169.0	290.5

*Source: Weather Bureau, U. S. Department of Commerce "Climatic Summary of the United States, Supplement for 19 through 1960—Montana."

UPPER RIGHT—Mechanic makes final inspection of a one-way reversible plow assembly. Reversible plows are being used to a greater extent on Montana highways today. This plow is not a "V" type. The blade is straight on the inside.

UPPER LEFT—A welder puts the finishing touches on a plow shoe. The old plow blades are shaped and fitted on the soles of these shoes, which are then attached to the bottom of the plows and ride on the highway surface to prevent plows from digging up the roadway.

CENTER—A sampling of the varied mechanization with which the Highway Department attacks winter in Montana is grouped in a highway shop yard. Visible units include an hydraulic sanding truck, wing plow, rigid plow, reversible plow and a rotary snow plow.

LOWER LEFT—A workman inspects the texture and moisture content of anti-skid material, which is piled high in the storage area of a district headquarters office.

LOWER RIGHT—Flashing lights indicate caution and expert hands make sure they are in excellent working order. This is typical of the work done during the summer and early fall days in maintenance shops throughout Montana.

The work horse of Montana's highway winter maintenance vehicles is the dump truck armed with a rigid plow in front. Staffed with one or two men, these vehicles patrol the more remote sections of state highway, plowing or sanding by shovel where necessary. Sand in the truck also serves as ballast.

utilize cinders from the railroad sidings whenever available. It costs about $1.50 per cubic yard to crush rock into sand and about $.75 per cubic yard to screen cinders. Coal mines of central Montana provide coal slack for anti-skid material, and lead and silver mines in the Missoula district and copper mining and processing in the Butte district provide mine dump and concentrator wastes for highway use in those areas.

Mixing of abrasives and chemicals is done with a front-end loader at the various stockpiles throughout the state. The treated materials are then either distributed there, or in some cases small stockpiles are hauled to particularly hazardous locations along the roadway, thus allowing immediate use and easy access to save time and money.

Each highway district stocks and supplies its own chemicals and anti-skid materials, storing them in maintenance garages. The smaller stockpiles along the roadways, however, are being stored in metal quonset huts where possible.

Battlegrounds Assigned

Montana's maintenance organization has a labor force of 600 full-time men. Several hundred more are "on call" for emergencies. Maintenance foremen and sectionmen head up crews on various lengths of the highway system. Each crew is assigned to a particular section of roadway, with the length of each section varying according to terrain and weather conditions.

Mountainous areas, of course, have the greatest concentration of men and equipment, where continuous operation and constant patrol is necessary. The more critical mountain passes and known trouble spots have crews in service 24 hours a day, if need be.

Alerted by a network of 307 radio-equipped cars and trucks, 26 base radio stations, and a statewide teletype system, this tried and proven system of maintenance forces is atop the most crippling situation before major problems arise.

The department has a full complement of trucks, sand and salt spreaders, bulldozers, scrapers and 457 snow plows of the rotary, rigid, reversible and "V" types. Equipment is distributed on the basis of miles of roads and amount of snow common to an area. Any section can

(*continued*)

Montana used about 75,000 tons of sand, cinders, coal slack and mine dump materials for anti-skid last winter. Bin-type spreaders such as the one pictured here played a major role in dumping this anti-skid material on the highways.

This type of mechanical spreader is used in heavy traffic areas and around cities because of its ability to lay down an even blanket of material. This scene is about 10 miles west of Helena along heavily traveled U.S. 12.

summon additional men and equipment from another section.

Maintenance snow removal and winter road equipment is purchased with an eye for cost, too. Calls for equipment come up through the district engineers and units are advertised and bought on low bid.

The erection of snow fence is a little known but equally important job of winter maintenance crews along Montana highways. An estimated 2 million feet of snow fence is erected and maintained each year at locations where past experience has shown that snow collects and blows into drifts, proving a hazard to drivers and additional plowing expense. Newer Interstate and Primary road construction alleviates drifting conditions and snow fences are declining in use.

Price of War

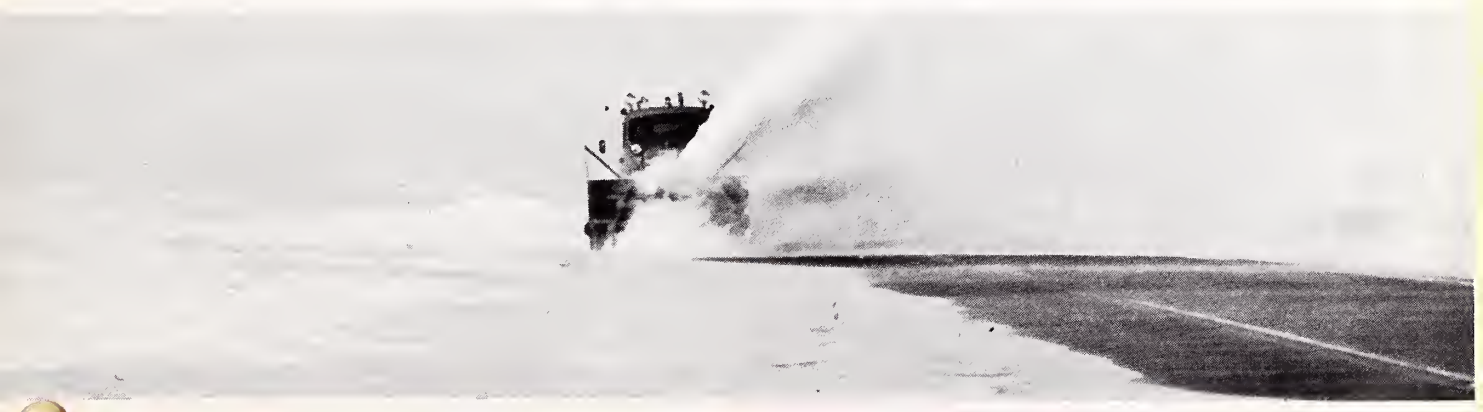
All this organization, equipment and manpower adds up to safety and convenience for the winter traveler in Montana. But it also adds up to a lot of money. The 1964-65 maintenance budget was $8.5 million. Of that sum, almost $1.2 million was spent on snow removal with an additional $818,000 on sanding and anti-skid materials. More than $37,000 went to purchase chemicals—thus making the cost of winter maintenance in Montana over $2 million.

These figures establish a rough expenditure of $303 per mile of roadway for winter maintenance. This figure compares with Pennsylvania's $700 per mile average cost for winter maintenance. Pennsylvania's total winter maintenance budget is $30 million.

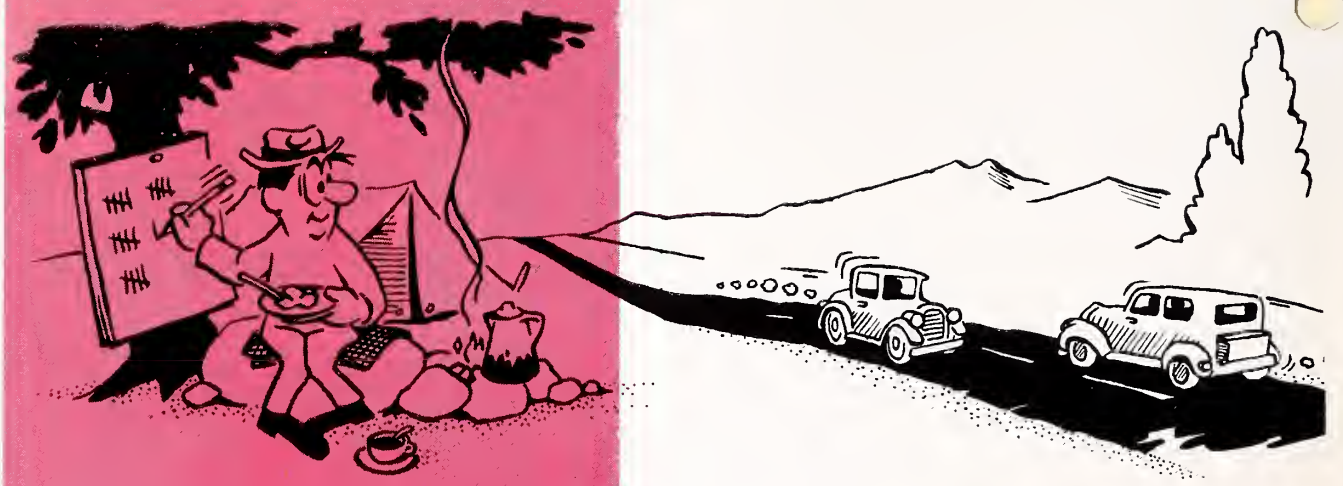
Montana's winter maintenance has proven itself. And it will prove itself to be an even tougher competitor in the winters to come. But in some areas, as has always been the case, amounts of snow and the frequency of storms will make the battle touch and go.

There is never any doubt, however, as to the winner. Planning, organization and spirited crews form an unbeatable combination.—END

Western Montana's mountainous regions receive the most snowfall, with extremes reaching 18 to 20 feet of accumulation as shown above on Logan Pass in Glacier National Park. The more extreme areas are blown out in the spring. However, daily maintenance keeps the lesser passes open year around despite accumulations of 10 and 12 feet during a winter. The poles seen atop the snow in this picture are pine saplings used in heavy snow areas to outline the roadway for snowplows.



Eastern Montana inherits less snowfall but presents an equally tough winter maintenance problem with blinding ground blizzards and hazardous drifing of snow across highways. Such blowing conditions can keep snow plows busy for days or even weeks after a snow fall.



Counted Categorized & Catalogued

You are being counted, categorized and catalogued as you drive Montana highways today.

In effect, you are a vital traffic statistic and highway engineers need vital traffic statistics before they can plan future roads or even improve the roads we already have. This makes you an important cog in the turning wheel.

It's the job of the planning survey section of the Highway Department to count traffic on all state roads. This section, headed by Paul DeVine, was formed in 1936 and traffic counting became a Highway Department function that same year.

While the methods of counting traffic have changed drastically over the past 30 years, the reasons for counting cars, trucks and buses have not changed. In fact, the importance of this job and the value placed on the results by highway designers and traffic control engineers has increased considerably.

Roughing It

The original counters of 1936 were men assigned to various locations throughout the state. These early day traffic counters were sent out from Helena armed with pencils, erasers, pads of paper, and issued knives, forks, cups and plates. They camped along the highways at night and manually counted each vehicle by day.

But human counters had definite limitations. Accurate 24 or 48 hour traffic counts were impossible. Labor costs were high, and the need was mounting for more locations to be counted than the human force could cover. Thus, the era of mechanical traffic counters was ushered in about 1940.

The first mechanical counters were a pneumatic type. A rubber tube stretched across the highway and counted each axle that passed over it. A simple adding machine inside a small box to the side of the road tallied the count.

(continued)

Origin and destination studies are an important preliminary to tomorrow's highways. Planning survey employees stop a certain percentage of vehicles, during specific hours and interview drivers as to where their trip began, their destination and the routes involved. This information tells highway engineers the direction of traffic, types of vehicles and whether the traffic is local, out-of-county or out-of-state. Mechanical counters can't provide such detailed information. (Staff photos)

Human traffic counters today record traffic flow from the comfort of modern automobiles. This is in sharp contrast to the counters of 30 years ago who camped out along roadways to obtain traffic data.

These first machines were home made and somewhat crude by today's mechanical counter standards.

Details Wanted

The major shortcoming of these early mechanical counters was that no particular time of day or week was ever noted. The counters simply tallied one axle upon another until the machine was cleared and reset.

Consequently, the need for more specific information forced development of new mechanical counters, including improved pneumatic systems, a photoelectric counter, radar counters and magnetic field systems.

Approximately 100 mechanical counters dot the roadsides of Montana today. Cost of these counters is about $450 a piece. Some counters in high traffic areas are permanent. Most mechanical counters, however are portable and thus allow spot checks to be made throughout the state.

Automatic counters print the time and number of vehicles on a tape similar to an adding machine tape. Normally, these machines record hourly and reset themselves. The tapes are collected and mailed to Helena's planning survey office for evaluation.

In cities or on major highways in the state, radar and photoelectric counters take over from the pneumatic type and register every 15 minutes, half hour or hour. This provides information to pinpoint peak or decreased traffic flows.

One of the newest counters to be used in Montana is only now being installed. The counter is triggered by the disturbance of a magnetic field created when a passing vehicle drives over a wire loop buried in the roadway. This new system is the same type used to trigger signal lights in many metropolitan areas of Montana.

Vandalism is high on mechanical counters. People are curious about those little boxes chained to a sign post or guardrail. Some believe them to be targets for rifles and shotguns. Others beat on them with hammers, run over them with trucks or tip them over, causing the acid inside to leak into the mechanism.

Damaged counters as well as counters due for regular checkups are shipped to Helena where a special shop does all the maintenance.

Human Element

The human element has not been entirely eliminated from traffic counting, however. Planning survey employs five full-time men and on some occasions a half dozen part-time people to make manual counts. These men are in addition to men who set out and maintain portable traffic counters throughout the state.

Today's manual counter is a far cry from those first men back in 1936 who camped out and ate meals off issued plates. The modern traffic counter (human) drives a good automobile, sleeps in motels and eats in restaurants.

The advantage of the manual counter is that the makeup of traffic passing a given location can be determined. Manual count log sheets can tell highway engineers the direction of traffic, types of vehicles and even whether the traffic is local, out-of-county or out-of-state.

Origin and destination studies are another field in which men are used. Planning survey employees stop a certain percentage of vehicles, during specific hours, and interview drivers as to where their trip originated, their destination and the routes involved.

With all these men and machines adding up all these figures comes the obvious question. What use is made of traffic counts?

Paul DeVine, planning survey manager, summarized his section's job this way: "The primary responsibility of planning survey is to obtain current traffic information and to consequently

(continued)

Robber's Roost still boasts of bullet holes in its walls and blood on its floor. Highway 287 today runs behind this aging landmark with the original trail from the gold fields running in the foreground. The Roost was the hangout of Montana's most famous road agents during the 1860s.

Charles Bovey (right) and one of many colorful characters that populate the restored historical sites along Highway 287 meet on the porch of the Nevada City Hotel. Bovey, a state senator and historian, is responsible for the revival of both Virginia City and Nevada City.

Sheridan is next on Highway 287, followed by a former railroad shipping point of bygone days—Laurin.

The Richest Gulch

A cluster of Alder trees beside the road heralds the mouth of one of Montana's most famous gulches. More than $9 million in gold dust was grubbed from the earth here at Alder Gulch during the last half of the 1800s. Mounds of gravel on either side of the highway attest to days of the big gold boom. Harvard University was a major stockholder in a gold dredge that operated around Alder Gulch as late as 1900. Today, fishing for large rainbow trout in the potholes created by the dredge operations is a thriving sport.

George Ives was the first man ever hanged by the citizen-lawmen known as the Vigilantes. Ives was hoisted up in Nevada City, a town of ghosts and weathered buildings beside Highway 287 today.

But restoration is going on in Nevada City. State Senator Charles Bovey, a dedicated historian who has already rebuilt Virginia City into one of Montana's most colorful tourist attractions, is busy now rebuilding Nevada City. One of the major attractions completed only last year is a restored railroad train, which runs between Nevada City and Virginia City for tourists.

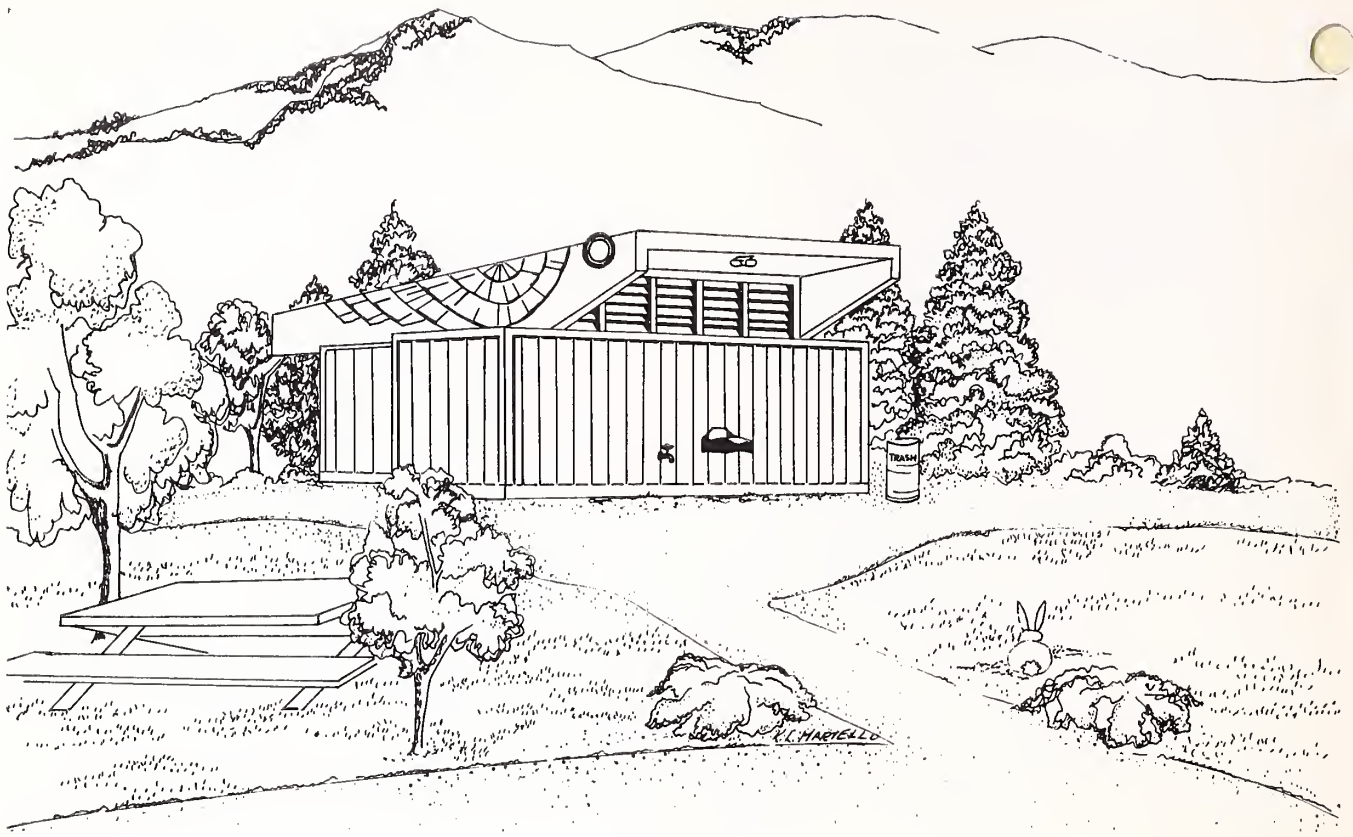
Virginia City, the more famous of Bovey historical towns, greets visitors from May to September with the roll of the honky-tonk piano in an ancient saloon . . . the clip-clop of horses hooves drawing stagecoaches of tourists up to boot hill . . . and the cry of the fair maiden in distress from the summer theater.

During the season, visitors can kick off their boots, dangle their toes in the stream that runs through town and watch an old timer pan for gold. Visions of gun fights and bar room brawls are everywhere in this authentic wild west town.

Facing the traveler to the east is the Virginia City Hill. Fifteen miles on the other side is Ennis and the end of Highway 287. This section of the state route wasn't paved until 1956. Prior to that, the Virginia City Hill was notorius among travelers in this area. It wasn't until 1920 that a passable road was even cut over the hill. The project cost $93,000 and was done entirely by hand labor. But at best the road was merely passable.

Winter snows and summer gumbo made the journey from Virginia City to Ennis a major adventure of two days in poor weather. Hard surfacing in 1956 did much to open this end of the gold country to tourists and through travel.

From atop the Virginia City Hill, a motorist can pause and look back over wealth, beauty and a major chunk of Montona history. He can indeed be satisfied that he's truely traveled over a Montana highway worth remembering.—END



REST IN PEACE

By M. R. WICKMAN
Road Design Engineer

Montana highway engineers will inject new life and color into a blossoming network of roadside rest areas this year. The object is to provide small pockets of beauty along our highways, in which weary motorists can rest in peace.

This move is just one more step in a scheduled build up of first class highway comfort stations throughout Montana.

Presently, there are 19 roadside rest areas in various stages of completion. Thirteen of these rest stops will receive finishing touches this year. Grasses, shrubs and trees will be planted. Picnic tables and in some cases shelters will be installed around the main rest area buildings. Parking areas will be paved or graveled and attractively marked off.

Heating to Come

Only heating of the main buildings for year-around use remains to be done. Heating the rest areas is a new development in the program and will be incorporated into original contracts for all future rest areas.

Landscaping and finishing touches will follow a basic pattern throughout the state. However, each rest area will have its own individual flare. Engineers are attempting to blend each rest area into the surrounding scenery. Only main buildings will be the same in every rest stop.

Rest areas have been an important part of Montana's road building plans for more than 10 years. Lack of funds, however, has forced engineers to develop the program gradually. It wasn't until last spring that Montana received any federal aid in its rest area building program.

Today's rest area design was standardized throughout the state in 1962. Since then, four Interstate rest stops and 15 primary rest areas have been partially completed. These areas boast a main building with running water, flush-type facilities, electricity and trash deposits. Approach and exit ramps are installed and the areas are open for public use.

Lacking in these 19 initial rest areas are the

finishing touches that spell the difference between a roughed out rest stop and an inviting little sanctuary for weary motorists.

Built to Last

The unique semi-circle design on each rest area building is a trademark of Montana. Inside the stout buildings are modern flush-type facilities and wash basins. A drinking fountain is attached to the outside of the building. The entire structure is engineered for low maintenance and a minimum of vandalism. All pipes, gauges and machinery are shielded behind locked doors and fixtures inside the buildings are kept to a minimum.

Outside lights turn on automatically with darkness and remain on until dawn, inviting night drivers to stop and rest. Overnight stays either by camping or within self-contained trailers is prohibited in all rest areas. Montana's rest stops are not designed as campgrounds.

Clean roadside rest areas are vital to the image of a state, and Montana is interested in its image. Highway Department maintenance crews mop, sweep and tidy up the comfort stations daily. A few high-use rest areas, however, require more attention. These stations are maintained by local persons hired by the Highway Department to supervise the rest stops several hours each day.

48 Spots Picked

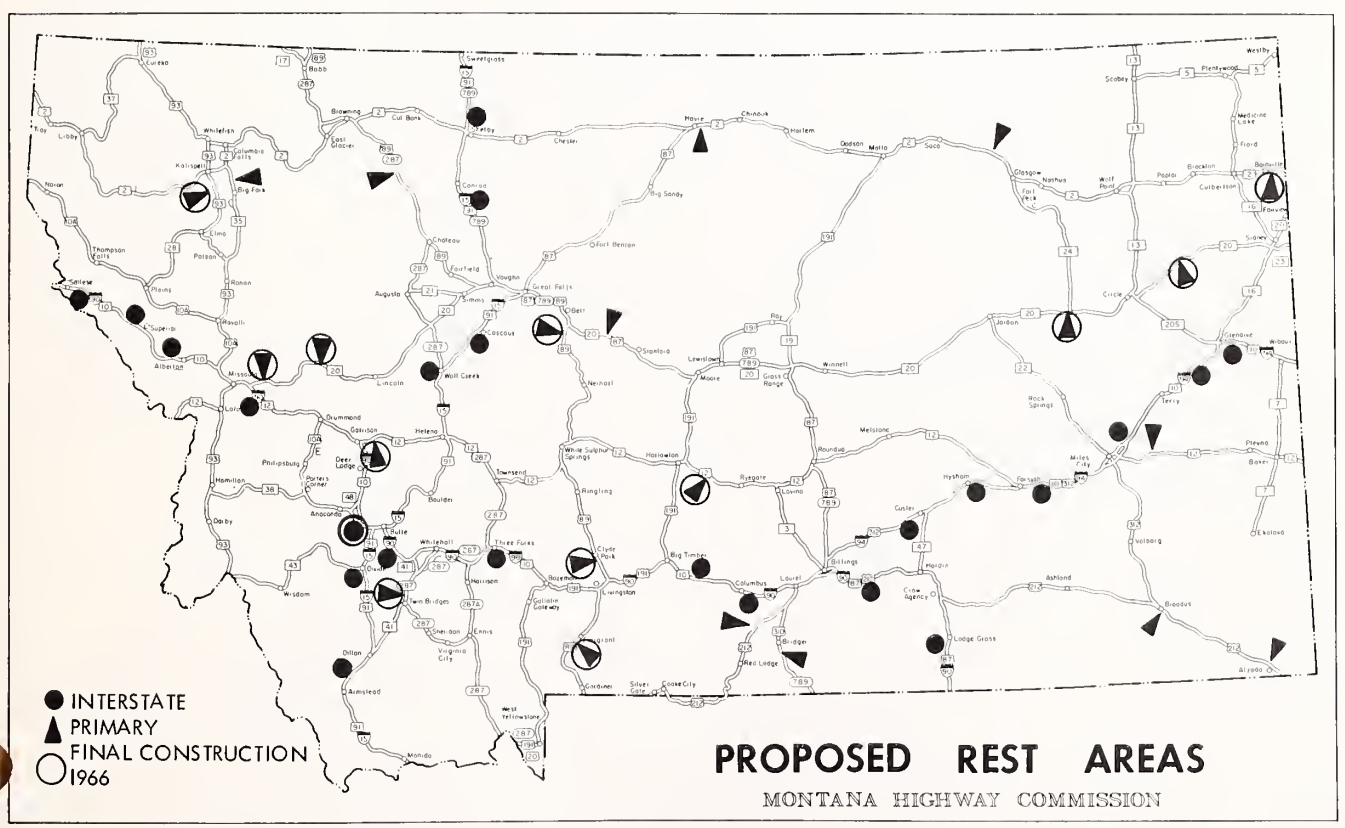
Locations for Primary road rest stops are selected by district engineers. Interstate design engineers in Helena choose the Interstate rest area spots subject to BPR approval. Quite often, historical markers or planned scenic turnouts have a great deal to do with where a roadside rest will be located. Such dual purpose areas are favored by engineers because they give drivers a chance to relax as well as take pictures of some bold Montana scenery or read of Montana's colorful past.

A minimum of 48 roadside rest areas are sketched into Montana's road network at present. The great popularity of these highway shelters indicates that more will soon be added to the system. Of those scheduled or abuilding today, 26 will follow the Interstate systems. An additional 22 will dot the primary highway network.

Interstate rest areas are slated for completion in 1972, the same year the Interstate highway system is scheduled for completion. Primary road rests will be finished as funds allow. The conversion to heated facilities of nearly 20 units already constructed may stall completion of Montana's entire system of roadside rest areas several years. The end result, however, will be more useful and certainly better equipped comfort stations for the traveling public.

The next time you spot a roadside rest area, pull over and stop. Stretch your legs. Sit down. Watch and listen to the world whizzing past.

Relax in the middle of Montana on a little piece of Montana real estate that is being tailored for you—the weary mortorist.—END



The Shoemaker and the Elf

By EDWARD C. MILLER
Data Processing Engineer

A revolution in highway building took place 10 years ago when the Federal Interstate highway program was launched. Roadway standards took mammoth steps forward. Spending was multiplied by the hundreds. And demands on men and machinery seemed unrealistic.

State highway departments just weren't geared for this revolution. They suffered a shortage of trained engineers. Working and office space was grossly inadequate, and production was limited to the speed of a slide rule in most cases. Highway engineers needed a catalyst to keep pace.

Electronic computers were the answer.

"You might say we are now in a position to do for the drudgery of highway engineering what power equipment has done for the hand labor of highway construction. Here is a renaissance in engineering," observed Harmon E. Davis, director of the University of California's Institute of Transportation and Traffic Engineering. This observation was made in 1957.

Another professor of engineering stated that with the electronic computer blended into highway work, an engineer has become the master of his tools rather than the slave of his calculation.

Mechanical Era

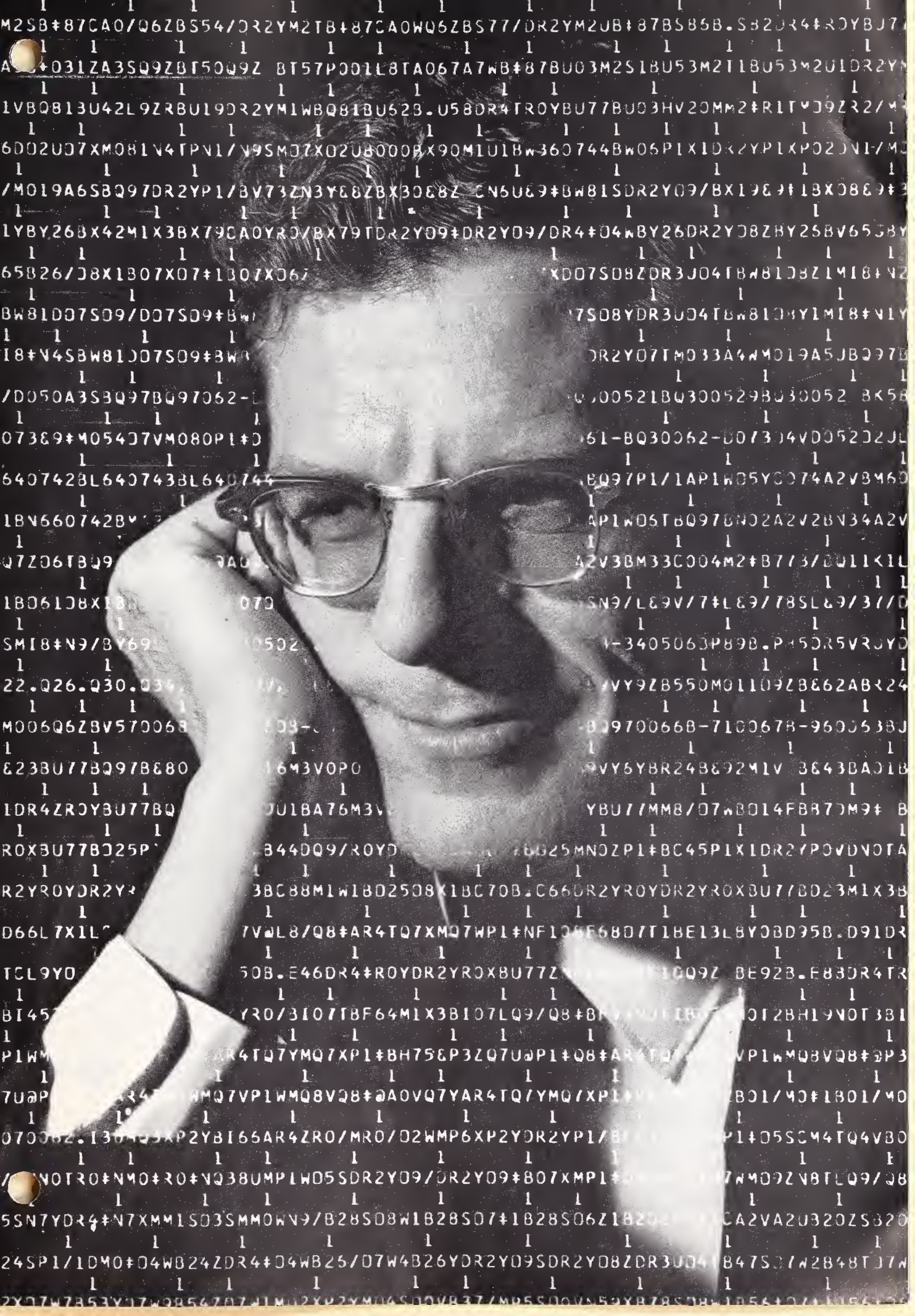
This "renaissance in engineering" is quite evident in Montana. Today, a short six years after the department installed its first electronic computer, machines are doing most of the routine accounting tasks. They are also computing traffic data, earthwork quantities, vertical alignment, route distances and areas.

A road plans engineer recently likened the use of electronic computers in highway construction to a fairy tale—The Shoemaker and the Elf.

"I just outline my problems on a coding sheet and hand it to the computer. The next morning, answers come back neatly typed as if an elf had

(*continued*)

Edward C. Miller →



A programmer and machine operator examine G.V.W. cab cards. The IMB 1403 is a 600 line per minute printer attached directly to the IBM 1401 computer. This 1401 system can process both alphabetic and numeric information and is consequently used for accounting and management reports.

A strong right arm pulls control wires from plug boards to alter basic machine functionsin the IBM 88 collator.

worked hard all night, doing my drudgery work," the engineer said.

In the alignment of bridges on spiral and horizontal curves, for instance, it takes hundreds of calculations to find elevations and distances of related points. Not long ago, an engineer estimated that 80 man hours would be required to compute the geometry of a bridge crossing requiring dual structures.

This same bridge job today, using the electronic computer, takes eight (8) man hours to outline the problem on coding sheets. The computer then takes 20 minutes to complete the job, giving the department an over-all savings of $250. Even more important, however, is that the answers were known two weeks earlier than would have been possible by conventional calculation. The direct cost saving ratio is about 5-1, but the time saving ratio was 10-1.

Savings Multiply

These savings, though significant, may be only a fraction of the final savings. Quite often a design change will alter all the spiral and curve information. To re-establish this information would take another two weeks of hand calculation, adding 14 days to a project's schedule. But in this day of electronic computers, the engineer merely changes a dimension on the coding form and in 20 minutes the computer has corrected all calculations.

Today's planning is the key to tomorrow's orderly and adequate street and highway networks. And, electronic computers are playing a big role in planning Montana's urban transportation. Much of this planning was impossible a few years ago because of the time and expense involved in compiling needed statistics.

A recent example was the Great Falls traffic survey. The daily movement of 66,500 persons in and around Great Falls was studied on a traffic model super-imposed on the thousands of memory cells in the machine. The model was comprised of the city's street network and the speed the average motorist can travel from one intersection to the next.

Traffic movement information was obtained from thousands of interviews with Great Falls residents.

The traffic model and collected traffic information were assembled into the computer's memory cells. Soon after, a comprehensive traffic survey of Great Falls, complete with forecasts of conditions and needs 20 years from now, came scattering forth from the mechanical elf.

Some of the data compiled included major traffic flow, average daily and weekly volumes on Great Falls streets, peak hourly traffic loads, accident statistics, driving times and distances as they exist today.

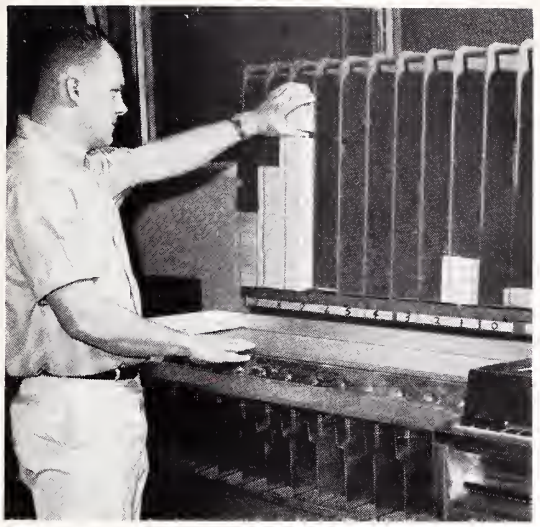
Computers are equally apt at forecasting traffic conditions 20 years ahead. Growth areas for residential and business are anticipated, and the population and land usage trends are projected. The resulting figures directly influence highway design, as well as future traffic development.

Accountant's Friend

The electronic computer is not only a slave to the statistician and engineer, but it also does equally well computing employee payrolls, posting ledger accounts, reporting taxes, controlling inventories, figuring equipment rentals, preparing personnel listings, determining service awards and scrutinizing budgetary expenses.

Indeed, the computer is an accountant's best friend.

Every month, over 2,000 claims, 21,000 payroll charges, 1,600 equipment rental charges and 10,000 journal transfers are captured on punch cards and fed to the computer. Devouring 1[illegible] cards per second, the computer quickly assembles the information into thousands of tiny



An IBM 83 sorter places card files in various orders, such as reference, division and account by dropping each card in one of 12 pockets. File storage is on top. The sorter is located beneath the operator's right hand.

doughnut-shaped iron memory cells. When the jobs are complete, earning charges have been summarized into payroll checks, taxes have been deducted, insurance premiums paid, union dues assigned, bonds purchased and individual earning statements produced, and the accountants have one monthly chore out of their hair.

Besides, with the individual earnings statement, each employee can look and see if the jolly giant of the mechanical world figured his payroll just right.

Claims against the Highway Department, meanwhile, have dropped into store's accounts for inventories, into W2 reporting areas for personnel traveling expenses, or into construction accounts when the claims come from contractors. Equipment rental charges are sorted and summarized for each passenger car, pickup, snow plow and other equipment. Reports show operating costs for vehicle miles.

Costs, Time Cut

To compute this gigantic accounting job, 2,000,000 holes in 25,000 cards are keypunched, verified, sorted, collated and computed each month. And the cost is surprisingly low.

Each claim is processed for less than $.20; each equipment rental for less than $.15 and each journal entry for only $.02.

More astonishing is the speed at which the computer reads the massive card files, completes calculations and finally generates the reports. A claim averages only 4 seconds, an equipment rental about 2 seconds, and a journal transfer 1 second.

To hand post detail ledgers and balance totals would require two to three minutes per entry and cost twice as much money.

From the financial data now stored in the computer's card system, numerous other reports

The IBM 1620 computer (background) is one of two data processing systems rented for highway use. This computer has 60,000 digits of core memory and is capable of computing answers for the most complex engineering problems.

can be drafted. For example, total expenditures for gasoline, telephone calls, office supplies and traffic signs can be tallied. Costs of union contract changes can be projected and budget control over each section or division in the Highway Department can be maintained by the computer.

The speed and accuracy of the electronic computer has also played a major role in the financial structure of Montana's Highway Department.

Every charge against a Federal aid project, be it for labor, materials, equipment or contractor's work, must be audited by the computer before it qualifies as a participating item for Federal aid. The computer has automated this auditing process. And, since its adoption, over $10 million has been collected from the Bureau of Public Roads which heretofore was backlogged, merely awaiting slower hand audit procedures to collect it.

The interest alone on this $10 million would more than pay the complete cost of the Highway Department's data processing organization.

Other Usage

A few years back, four men spent two weeks each year calculating mileage between Montana cities for the official highway map. Today, this same chore is completed in a few hours.

(continued)

Another large user of the Highway Department's computer system is the Gross Vehicle Weight division, which collects yearly prorated taxes on some forty thousand trucks and trailers. The computer wades through fleets of vehicles, calculating G.V.W. registration, license plate and other special fees and evaluating vehicle property tax assessments.

Prior to the electronic computer era in Montana, girls typed out all of the above licenses and billings, while accountants figured prorated taxes and special fees by hand. The result was a huge backlog of G.V.W. work each year, causing enforcement of G.V.W. laws and tax collections to be delayed. These delays cost Montana's highway program considerable revenue.

Future Growing

The future of electronic computers in the Montana Highway Department is even more promising than the past.

With a new multi-processing computer on order, which will handle more than one job at a time, and incorporating tele-processing, which accepts data and instructions from remote stations over telephone lines, the versatility, capacity and speed of the Highway computer system will increase greatly.

Even though the computer used today is fast, computing earthwork quantities at the rate of 17 miles-per-hour, it often takes hours to prepare card files in proper order and with necessary changes before computing can begin.

The new computer will have random access files containing millions of digits of information, thus allowing for immediate up-dating of personnel and financial records. It will make detailed searches of historical files, compile statistical studies and will produce bar charts or plot line graphs instead of just long numeric reports.

The day is coming in Montana when electronic computers will have eyes to read the printed word and be able to accept the human voice. Experts also foresee three dimensional views of design drawings, landscaping, legal documents, etc., displayed on a television-like tube as it comes off the computer.

No Fantasy

Such electronic age activity might sound a bit fanciful right now, but such computers actually exist. Large corporations such as General Motors have television computers, if they can be called that, operating now. Such advanced computers are forecasted for highway builders.

The future designer might sit before a TV tube and watch his design sections slip beneath him, just as though the were already driving over the road surface. Road signs could be tested for visibility, traffic volumes checked and interchange connections observed for safety. A sign relocation or perhaps a widened section can be executed by stopping the computer briefly while the designer draws in the desired changes on the TV tube with a light pen.

After the old information is erased from the computer's memory, and new information accepted, the computer will back up and review the change as it again passes through on television. Any area could be expanded to a larger scale for detail or reduced to a smaller scale for a wider view of the surrounding terrain.

Indeed, the era of the mechanical elf is just beginning in Montana's Highway Department. —END

Data processing has over 14 million computer cards in storage. Such bulk storage is cumbersome. Data contained on these cards will soon be transcribed to magnetic tape, which will allow immediate access and reduce storage space requirements.

Highway Life Lines

What's white, reflects light and is found on the highway? Some people might say snow. But a seasoned traveler is more apt to answer highway striping—those life lines painted on nearly every highway in Montana. (*continued*)

Truck-mounted striping machines carry the burden of center line marking in Montana. Last year, 11 truck-mounts and five smaller push-type sprayers laid down 140,000 gallons of reflectorized paint on Montana highways, at a cost per mile of $35. Despite a tremendous increase in the amount of center line marking, the price per mile has not increased since 1949.

Thousands of motorists in Montana literally lay their lives on these "lines" every day. Undoubtedly, you have yourself. A sparkling center line or shoulder stripe is indeed a welcome sight to motorists on a dark night. They're even more welcome in snow storms, ground blizzards or fog.

Ordinary, non-reflectorized paint could be used, and in fact was used until 1947, to stripe highways. But the biggest safety factor in highway of striping today is reflection, or the ability to reflect automobile and truck headlights at a great distance. Because of this reflectorized traffic paint, manufacturers state that visibility is increased 100 percent over older traffic paints.

One-Third Glass

The secret of reflectorized traffic paint is glass. Tiny glass beads, about the size of salt granules, are dumped into traffic paint. The recipe is four pounds of glass beads to each gallon of traffic paint.

This means that highway center lines and shoulder stripes are one-third glass.

These tiny glass beads are made to float in the paint. The density of the paint is made equal to or more than the density of the glass beads. Also, the force with which a striping machine sprays paint on the highway surface is part of the "floating beads" secret.

Unlike Montana, some states don't float their reflector beads in paint. Instead, they drop the beads on to the center lines and shoulder stripes after the striper has passed. Montana tried this method in 1958 and found no appreciable advantage over the floating beads method.

Not House Paint

Traffic paint differs in other ways, too, from ordinary house paint. Traffic paint is quick drying, hardening to a no-smear condition in 15 to 20 minutes. A solvent is added during the paint's production that prevents the black color of asphalt from bleeding through the white.

Plain traffic paint has a greater abrasion resistance, too, and it dries to an extremely hard finish.

Quick drying and durability characteristics of traffic paint, which are caused by the use of alkyd, are vital to the business of highway painting. Automobile and truck tires would have a freshly painted center line smeared in every direction if the paint wasn't fast drying. Keeping some motorists off fresh traffic paint is quite often as fruitless as telling children to keep their hands out of a cookie jar.

Tough as Nails

Durability or abrasion resistance is equally important. Imagine the abrasive forces involved when car and truck tires twist and grind sand

(continued)

A worker in the Columbia Paint Company factory in Helena empties another bag of white pigment into a batch of traffic paint being prepared for Montana highways. Columbia Paint has been the major supplier of traffic paint to the Highway Department since 1949. Traffic paint contracts are let yearly through competitive bidding.

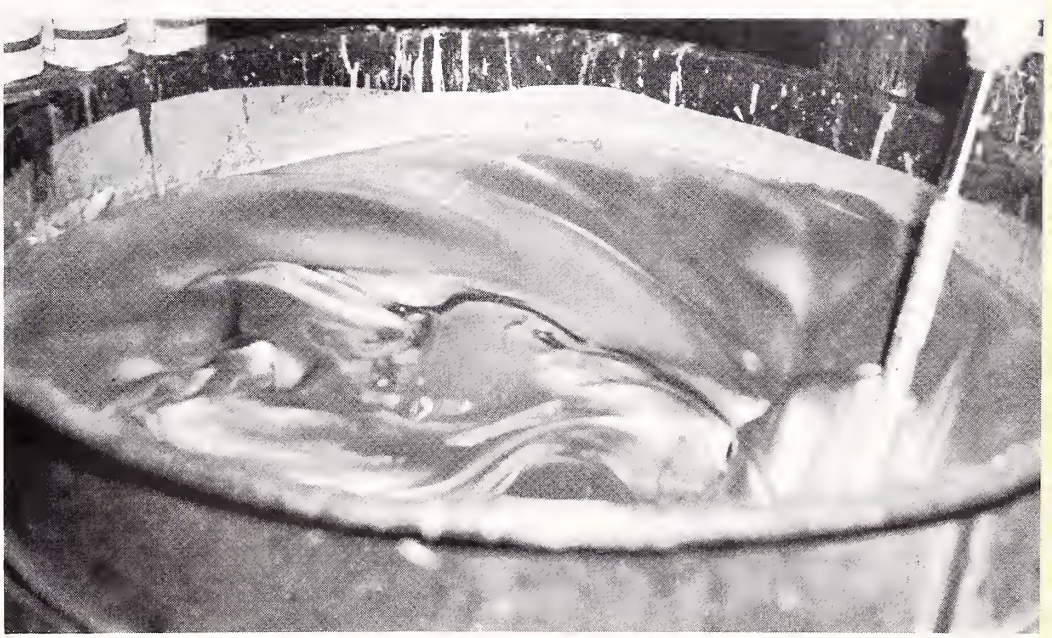
dirt, de-icing salts and gravel into center lines and shoulder stripes every day of the year. Ordinary house paint would last maybe a month under normal traffic conditions.

But traffic paint is manufactured to strict federal government specifications. These standards have created a traffic paint that will last between 18 months and two years under normal traffic conditions. Heavy traffic, however, takes a quick toll. An average striping job on Helena's busy Montana Avenue, which carries an average daily traffic count of over 10,000 vehicles, will last perhaps three months.

On the other hand, there are numerous cases where striping lasts for three or more years on low-use secondary or county roads.

Montana began striping dangerous sections, high-use areas or lengths of highway noted for heavy ground fog back in 1936. It was in that year, that 15,400 gallons of traffic paint were sprayed on 2,759 miles of highway. The entire year's job cost the state department $19,700 or a ltitle more than $7 per mile, including all labor, paint and equipment. It took 12½ gallons of paint to single stripe a mile of roadway. This was all done with one striping machine.

(continued)



Reflectorized traffic paint in its final mixing stage of manufacture looks like a giant vat of liquid moon beams. When ready, this traffic paint is put up in five-gallon cans and shipped to the five district highway offices.

Single white lines, either solid or broken, were the only center lines until 1949-50 when the barrier or yellow line was instigated in Montana. It was that year that the cost of striping rose to $35 per mile and remains at this figure even today.

Shoulder striping was begun in Montana in 1961, thus increasing the amount of traffic paint used by thousands of gallons. More frequent painting and additional road systems like the Interstate highways have also added to the volume of paint used.

Costs the Same

In 1965, more than 140,000 gallons of white and yellow traffic paint were ordered from the Columbia Paint factory in Helena by the highway department. This paint was sprayed by 11 truck-mounted sprayers and five push-type sprayers on nearly 7,000 miles of highway. Today, every division but one has its own truck-mounted striper. About a quarter of a million dollars was spent in painting safety on to the roads of Montana in 1965. Cost per mile ran just about $35, or the same as in 1949.

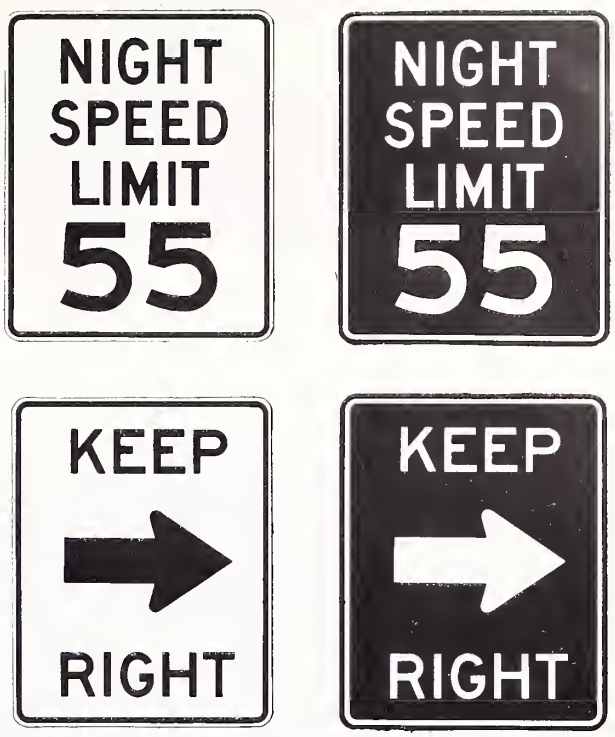
Last year, white paint was used two-to-one over yellow traffic paint in Montana.

Highway striping in Montana last year, if stretched end to end, would amount to a center line over 25,000 miles long—or equal to the distance around the world. If these white and yellow safety lines were rolled up into a ball, they would weigh 1.5 million pounds or 750 tons. The paint it took to make center lines and shoulder stripes in 1965, if poured over the ground, would cover 331 acres.

The great length of Montana's center line and shoulder striping is obvious to every traveler. But the safety factor involved in this sizeable job, accomplished by Montana Highway maintenance crews, is not quite so obvious until it is desperately needed . . . then, there is no substitute for the engineering, the man hours and money that have created those highway life lines.—END

The secret of reflectorized traffic paint is tiny glass beads about the size of salt granules. This glass is mixed into the traffic paint during manufacture. The recipe is four pounds of glass beads to each gallon of paint, thus making center lines one-third glass. (Staff photos)

Black & White



White on black, or black on white? Which is easier to see at night?

Research into this and other traffic control questions by Montana Highway Department traffic engineers has brought about a color change in at least two types of highway traffic signs. This color change, however, is but a small part of an over-all program to update Montana's lengthy system of highway signing.

Night speed limit signs and "KEEP RIGHT" signs, which are of major importance during night hours, have been produced with black lettering on a white background for years. But the colors will be reversed on all future signing of Montana highways.

Less Glare

The idea that black backgrounds cut down on headlight glare at night has prompted this change. Research has proven that with background glare reduced, the actual visibility of the sign is greater.

Also receiving a major color change will be Montana's secondary road signs. Formerly white numbers on a black arrowhead on a white background, the new signs will be just the opposite in color.

Other physical changes planned for future highway signing include replacement of yellow "STOP" signs with larger red signs. Many highway signs in general will be larger in size. Sign posts will change from steel to wood.

These switches in sign appearance are part of an extensive program aimed at resigning every mile of the state's roadways.

Already, 550 miles have been updated with modified, enlarged and new signs. This mileage comprises four separate projects: Missoula to Kalispell along U.S. 93; Garrison Junction to Forsyth on U.S. 12; Townsend to Three Forks Junction along U.S. 287, and Lavina to Billings on State Route 3.

Great Falls and Missoula are the next targets for the resigning program.

Uniform Code

Montana's highway commissioners adopted a uniform signing code in 1962. The code was established after considerable research by the Federal government. Based on the standards of the code, the entire state of Montana must be resigned, including city streets.

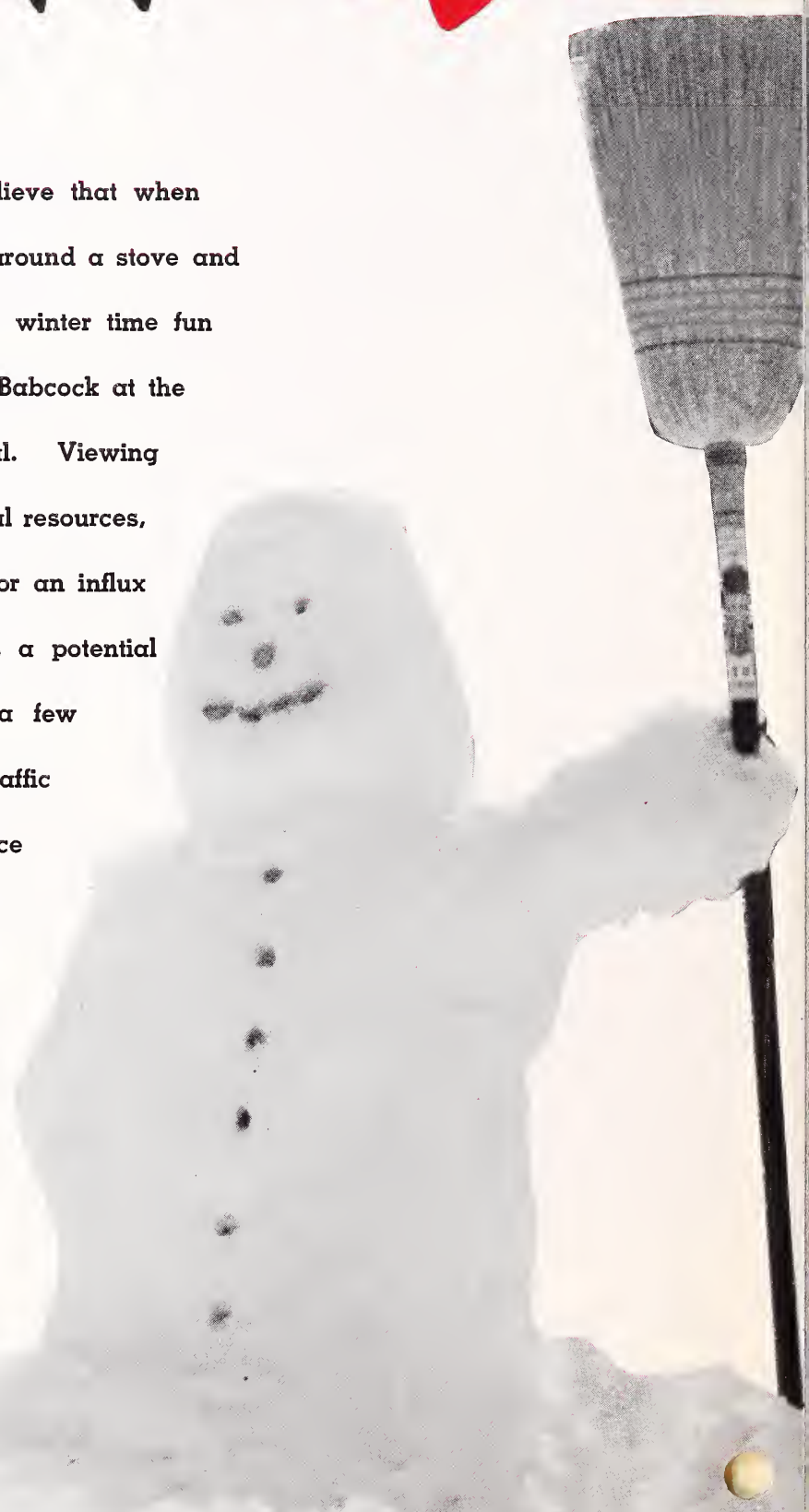
City and county officials are responsible for updating their respective networks of streets and roads. State Highway engineers are revising the signs on the Primary system of highways, including Primary roads inside city limits. Counties are responsible for resigning Secondary roads.

Part of this resigning program is the establishment of a mile post system along Montana's Primary and Interstate highways. The signs are green and white. These posts play an important role in recording accidents, as well as pinpointing trouble spots for maintenance crews.

Work on the resigning projects is being both contracted out to independent contractors and handled in some cases by the maintenance section of the Montana Highway Department. Cost of this extensive program is shared with the Federal government under Federal aid for highways.—END

Whitefish Winter

"Many from outside our borders believe that when winter comes, we go inside, huddle around a stove and hibernate. I wish they could see the winter time fun in Whitefish." This from Governor Babcock at the 7th Annual Whitefish Winter Carnival. Viewing cool temperatures and snow as natural resources, more Montana areas are preparing for an influx of winter time vacationers. This is a potential for gas tax revenue unthought of a few years previous. It could change traffic counts and alter winter maintenance practices. A bad winter in Whitefish is one where they have to haul snow in to put on the streets.



Carnival

A civic spirit pervades Whitefish. A spirit worthy of emulation by any community.

"At first," said one resident, "We had only skiing but now we have other amusements. And you can break a bone just as easily on these newer things as you ever could skiing."

Broken bones or not, it's winter fun in Whitefish each year as this northwestern Montana community stages its annual Winter Carnival. This year's carnival was held February 18-20.

On the right is a game of broom hockey. Fouls in this game are penalized by sawing off a chunk of the player's broom handle. Below is a typical ski scene on Big Mountain, with Flathead valley obscured by clouds.

The following page depicts other forms of winter fun at Whitefish's annual carnival.

SKIJORING is the name of the game. A horse pulls the skier via a tow rope up a ramp and the skier hurls through the air (left photo). The longest jump wins completition. In the right photo, an exhibition skier at Big Mountain Ski Resort demonstrates a fiery hoop jump while skijoring.

SNOWMOBILES of every description can be found on the streets of Whitefish during Winter Carnival time. Races between these playful machines provide thrills for viewers and participants alike.

A TORCHLIGHT slalom down Big Mountain, complete with fireworks bursting overhead, is one of the most unforgetiable annual events at the Whitefish Winter Carnival.

Highway MAIL BAG

THANKS FOR NO BY-PASS

Gentlemen,

The communiy of White Sulphur Springs wishes to thank and commend the Montana Highway Commission and others responsible for the approval and construction of the recently completed highway project which was routed through the town.

It is significant to note that in this town of 1,200 population, local businesses have invested over $200,000 in buildings and improvements in the last two years. This investment is a direct result of the road project and would not have been made otherwise.

Had the town been by-passed, it would have deteriorated in the usual pattern; instead, White Sulphur Springs is working on improvements which will not only make for a more desirable community in which to live but also makes for a more pleasing appearance to the people who tour the State of Montana.

J. W. Lehrkind, Mayor
City of
White Sulphur Springs

K. J. Peterson
Councilman

Roy C. Swan
Councilman

Mike Baechler
Councilman

James A. Dempsey
Councilman

BOZEMAN APPRECIATION

To the Commission,

As the 1965 President of the Bozeman Chamber of Commerce, I wish to express my appreciation to the Montana State Highway Commission, the United States Bureau of Public Roads, Schulz and Lindsay Construction Company, the personnel of the local office of the Montana Highway Commission and, most of all, to Division Engineer, George Barrett, for the excellent manner in which the highway projects on Bozeman's North Seventh Street and Main Street were conducted. It is truly a superior piece of construction.

The willingness of the Contractor and the Highway Department to work as a team, regardless of unforseen adversities, permitted this project to be completed with the least amount of inconvenience to the public and the merchants of Bozeman. In every respect all of the responsible parties were extremely courteous and very cooperative. At no time did I hear any complaints from the citizens on Main Street and North Seventh that the job was not being conducted in the most efficient manner.

As civic representative of the people of Bozeman, it has been a great deal of pleasure and satisfaction for me to be associated with each and every one of the parties who were so responsible in building the city of Bozeman a much needed highway.

Hiney P. Lund
President
Bozeman
Chamber of Commerce

DE BORGIA GRATITUDE

Dear Mr. Johnson,

I want to take this opportunity to thank you, and all those others of the Montana State Highway Department for the efforts they made in behalf of our little town of De Borgia. We all owe you a deep debt of gratitude for your kind and humane actions, and I know it has made everyone here feel a whole lot better. I feel the future will justify all you have done, and I can assure you it has given us all a big lift, and a better outlook for the days to come. If there is anything I can do for you and those of the State Highway Department at any time, please do not hesitate to let me know.

William A. Keenan

WINTER MAINTENANCE

Dear Sir,

Since it is easier to write a letter when you have a complaint, I imagine you receive more of that kind. However, we feel a compliment is in order and decided to tell you so.

The road crews which have the Bad Rock Canyon-Coram area have kept these roads in the best winter driving conditions they have ever been in since we have lived in this area. They are out early before the school buses and late if the weather condition calls for it. We would like you and the crews to know that we in the area appreciate and thank them for their work.

Mr. and Mrs. Rex Breneman

MISSOULA SIGNING

Dear Sir,

For the Central Montana Highway Association, would you please pass on our thanks for the courteous reception of the Highway Commission and sympathetic handling of our Missoula signing problem. We think the action undertaken by the Commission—if successful—is an ideal solution. In fact, better than routing over the Interstate.

R. Bruce Shelton
Executive Vice President
Central Montana
Highway Association

Montana Highway Commission
Highway Building
Helena, Montana 59601

Return Requested

ED A DALAKOW
703 DEARBORN
HELENA MONTANA 59601

See page 13-14

BULK RATE
U. S. POSTAGE
Helena, Montana
Permit No. 35

Highway Humorist

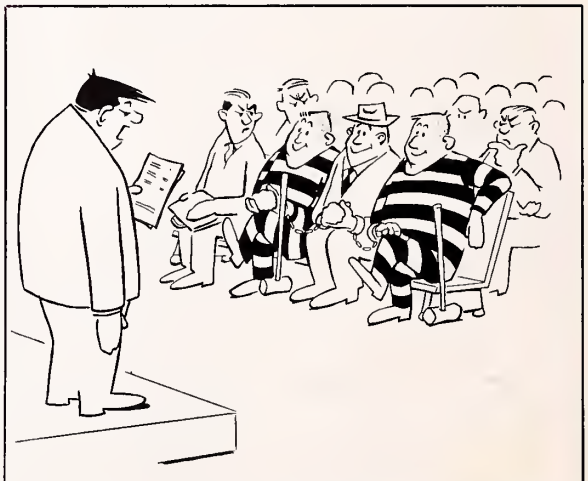
To capture the lighter side of highway life with pen and ink is indeed an outstanding talent. Possessing that talent in Montana's highway organization is Jerry Fagn, a road designer in the Billings district office.

The accompanying cartoons are but two of a portfolio of highway humor completed recently by Fagan. Illustrations on page 8 of this issue of Center Line, accompanying the story "Counted, Catagorized and Catalogued," are other examples of Fagan's ability to sketch wit into the serious busines of building highways.

A Columbus, Montana, native, Fagan joined the Highway Department in 1963 in the Butte district office. A recent transfer jumped the highway designer into the Billings district. Being a cartoonist is merely a side line interest with Fagan, who finds his free hours away from the regimentation of a drafting table the best for capturing highway humor in cartoons and illustrations.

Several national and regional highway publications have expressed a desire to see more of Fagan's work, indicating his fine ability to express humor with pen and ink.

"The district engineer is very busy right now . . . . . could you contact him later?"



"And now . . . the low bidder on this month's gravel crushing project . . . "